Additional Comment on Fabry-Perot Type Resonators*

In a recent paper on Fabry-Perot type resonators,[1] Culshaw makes reference to a note of mine[2] to the effect that one of the rather lengthy formulas (5) in my paper is incorrect. I should like to point out the errors as they appeared in our internal research report:

1) A "$\frac{nb\lambda}{\gamma}$" should have been a "$\frac{nb\lambda}{8}$."

2) A "$\frac{\pi}{b\lambda}$" should have been a "$\frac{2\pi}{b\lambda}$."

These are, however, typographical errors, as can be seen from the fact that the final numerical values and graphs given by Culshaw reproduce mine down to the fourth decimal place.

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[1] W. Culshaw, "Further considerations on Fabry-Perot type resonators," IRE Trans. on Microwave Theory and Techniques, vol. MTT-10, pp. 331–339; September, 1962.

[2] C. L. Tang, "On Diffraction Losses in Laser Interferometers," Raytheon Research Div., Waltham, Mass., Tech. Memo T-320, October 23, 1961.

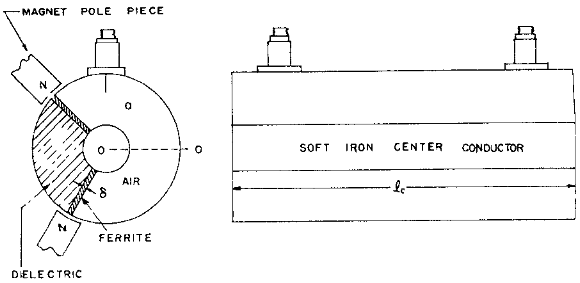

Fig. 1—Experimental cavity showing the arrangement of the dielectric and ferrite materials. Type M-063 ferrite manufactured by Motorola Solid State Electronics Department was used inside the cavity along with Stycast Hi-K dielectric material (K_e=15) manufactured by Emerson Cuming, Inc.

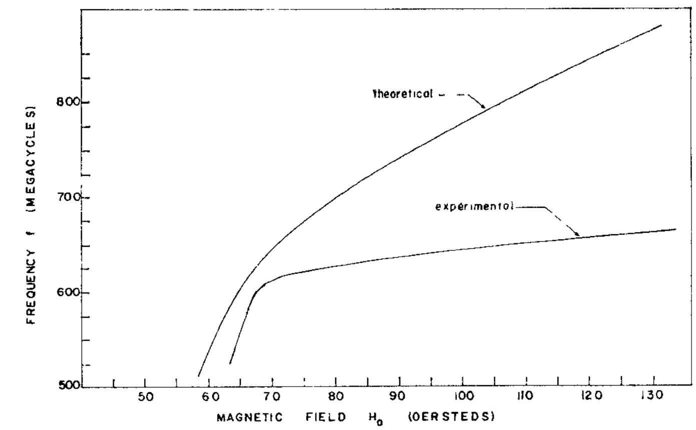

Fig. 2—Tuning curves for experimental and theoretical results.

$\beta=\pi/l_c$ radians/cm. $l_c=7.62$ cm
$\delta=0.382$ cm $K_d=15$
$a=1.75$ cm $K_f=13$
$c=1.35$ cm

A Ferrite-Tuned Coaxial Cavity*

This communication presents a calculation of the electromagnetic wave propagation constant β in a coaxial cavity partially loaded with ferrite and dielectric materials. The cavity was designed to operate around 600 Mc. The advantage of using a coaxial cavity compared to a rectangular cavity at 600 Mc is the fact that a coaxial cavity is much smaller than a rectangular cavity. Electronically tuned cavities have been built utilizing ferrite materials in the X-band frequency range.[1] However, until recently no ferrite materials have been produced that could be used feasibly in the UHF frequency range. Tuning cavities with ferrites has certain advantages that some other electronically tuned cavities do not have with regard to power relations. For example, cavities have been built that are electronically tuned with the use of varactor diodes.[2] These types of cavities cannot tolerate medium power levels, whereas, ferrite materials can withstand higher powers.

An experimental cavity was constructed and it is shown in Fig. 1. The outer conductor was constructed from a brass pipe with a $1\frac{1}{4}$-inch inside diameter. The inner conductor was constructed from a soft iron rod. The reasons for using the iron center conductor was so that the applied magnetic field would be more uniform in the ferrite and the applied magnetic field would be perpendicular to both the inner and outer conductors. The propagation constant β has been derived previously for the loaded waveguide and the loaded coaxial line.[3] The results were given in a slightly different form than those which are presented below.

$$\begin{aligned}(F^2\beta^2 + k_m{}^2\rho^2)\cosh K_a a \sin k_m\delta \\ + \beta F K_a \sinh K_a a \sin k_m\delta \\ - K_a\rho k_m \sinh K_a a \cos k_m\delta \\ + k_d K_a \sinh K_a a \sin k_m\delta \tan k_d c \\ + k_d K_m\rho \cosh K_a a \cos k_m\delta \tan k_d c \\ + k_d\beta F \cosh K_a a \sin k_m\delta \tan k_d c = 0\end{aligned}$$

where $F=-j\rho/\theta$. (See Button[3] for the definition of other symbols.)

This equation may be written symbolically as

$$F(f_0, H) = 0$$

where f_0 is the resonant frequency of the cavity and H is the applied static magnetic field. Hence, one could obtain the resonant frequency by knowing the magnetic field.

The IBM-650 digital computer was programmed to solve this equation for our case. Fig. 2 shows the results obtained by computation and by experiment.

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[1] C. E. Fay, "Ferrite-tuned resonant cavities," Proc. IRE, vol. 44, pp. 1446–1449; October, 1956.

[2] S. T. Eng, "Characterization of microwave variable capacitance diodes," IRE Trans. on Microwave Theory and Techniques, vol. MTT-9, pp. 11–22; January, 1961.

[3] K. J. Button, "Theory of nonreciprocal ferrite phase shifters in dielectric-loaded coaxial line," *J. Appl. Phys.*, vol. 29, pp. 998–1000, June, 1958.

Some Remarks Concerning "Conditions for Maximum Power Transfer"*

In these Transactions Shulman[1] studied the conditions for maximum power transfer.

It should be noted that in the *Comptes rendus de l'Academie des Sciences* (Paris, France, vol. 252, pp. 689–691; January 30, 1961) we studied this problem in the general case on the Smith Diagram. The method de-

* Received December 3, 1962.

[1] C. Shulman, "Conditions for maximum power transfer," IRE Trans. on Microwave Theory and Techniques (*Correspondence*), vol. MTT-9, pp. 453–454; September, 1961.